DESCRIPTION OF THE CARDIOVASCULAR MEDICINE FELLOWSHIP PROGRAM

Division of Cardiovascular Medicine
Oregon Health & Science University

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I. Fellowship Program Overview and Goals

This document describes the learning objectives and environment for the Oregon Health & Science University (OHSU) Cardiovascular Medicine Fellowship Program. The overall aims of our fellowship program are to train outstanding clinicians in the field of cardiovascular medicine, to nurture interest in scientific investigation, and to help trainees reach their ultimate career goals. This program meets the requirements of and is accredited by the ACGME, and provides the necessary infrastructure for each fellow to reach the requirements and performance goals for sub-specialty board certification in Cardiovascular Medicine by the American Board of Internal Medicine. The faculty and staff of the Cardiovascular Division at OHSU are clinician-educators and scientists who are dedicated to the task of training tomorrow's cardiologists. State-of-the-art practice of cardiology is

taught in an environment that retains a personal touch.

The educational program is based on curriculum, mentorship and experiences in a variety of settings including: 1) inpatient cardiovascular services, 2) outpatient cardiovascular practice; 3) clinical laboratory or procedure-based services; 4) conferences; and 5) investigational/research laboratory. Although the cardiovascular fellowship is a three-year accredited program, a four-year curriculum that includes expanded research activities is encouraged as part of our goal of training cardiovascular clinician-scientists.

The training program is designed to emphasize that cardiovascular physicians diagnose and treat lifelong disease states in cooperation with other primary and specialty physicians and function within a health care system which has economic and long-term outcome priorities. The post-graduate fellowship in Cardiovascular Medicine is directed to the goal of educating and producing subspecialists who:

- Provide patient care consistent with health maintenance and health promotion through the:
    - Understanding and practice of early detection and patient education, and
    - Understanding and application of principles of clinical epidemiology.

- Manage ill patients by:
    - Diagnosis and management of serious, acute disease,
    - Evaluation and management of chronic and terminal disease and the social and emotional components that accompany them in both inpatient and ambulatory care settings,
    - Diagnosis, treatment, and management of acute ambulatory problems, and
    - Diagnosis and treatment of medical problems in the emergency care setting.

- Understand of the psychosocial aspects of disease and the impact on the practice of medicine

- Maintain themselves as health care providers by:
    - Managing large volumes of patient data in a problem-oriented format and using clinical record systems to monitor and evaluate quality of care,
    - Directing their own learning in a systematic and continuing manner, and
    - Understanding medical ethics.

- Understand the scientific basis of the practice of medicine by:
    - Practical experience in hypothesis-based research programs, and
    - Analytic approach to evaluating scientific studies and evidence.

In our training program, the practice of cardiovascular medicine is taught using multiple teaching methods. At the conclusion of training, a cardiology fellow will have achieved the following milestones in the ACGME core competencies:

- Patient Care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health.

- Medical Knowledge about established and evolving biomedical, clinical, and cognate (e.g. epidemiological and social-behavioral) sciences and the application of this knowledge to patient care.

- Practice-Based Learning and Improvement that involves investigation and evaluation of his/her own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care.

- Interpersonal and Communication Skills that result in effective information exchange and teaming with patients, their families, and other health professionals.

- Professionalism as manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population.

- Systems-Based Practice as manifested by actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value.

II. Clinical Training

A. Clinical Training Summary

Clinical training activities are performed at OHSU Hospital and the VA Medical Center which are located on the same campus. Clinical training generally encompasses a minimum of 24 months of fellowship. The content of the clinical years will vary depending on the specific interests and career goals of the trainees, but is structured to satisfy the components for clinical training as recommended by the ACGME and ABIM. Further goal-directed refinement of the schedule is recommended for those who wish to achieve competency or expertise in a specific area and to satisfy further subspecialty board or COCATS requirements.

B. Mandatory Clinical Rotations (1 month duration)

- Cardiac Critical Care Unit and Inpatient General Cardiology Service (OHSU)
- Cardiology Consult Service (OHSU and VAMC)
- Cardiac Catheterization Laboratory (OHSU and VAMC)
- Noninvasive Imaging I (echocardiography, radionuclide imaging, stress testing) (OHSU and VAMC)
- Noninvasive Imaging II (MRI, CT radionuclide imaging) (OHSU)
- Heart Rhythm/Electrophysiology Service (OHSU)

- CHF/Transplant Service (OHSU)
- Weekly Outpatient Clinic/Ambulatory Care (OHSU and VAMC).

C. Elective Rotations (1 month duration)

- Adult congenital heart disease
- Peripheral vascular disease
- Advanced cardiac imaging
- Advanced heart failure/transplant
- Cardiac surgery and post-surgical care

D. Fellowship Clinical Track:

1st Year (basic template)

1 EP	3 Imaging	3 Cath
1 CHF	2 CCU/Inpatient	2 Consult

2nd Year (basic template)

1 EP	3 Imaging	2 Cath
1 CCU/Inpatient	1 Consult	4 electives

E. Basic Requirements for Graduation from ACGME-accredited Program

The following list represents the minimum requirements for graduation from an ACGME-accredited program in cardiovascular medicine. All of these requirements must be met in order for a fellow to graduate from the training program and be eligible for ABIM board certification in adult cardiovascular medicine. It should be noted that these requirements are minimum standards. For many of the components of training, there are COCATS guidelines set forth by the American College of Cardiology that define levels of expertise and are used to define eligibility for taking certain subspecialty boards (such as National Board of Echocardiography, Nuclear Medicine Technology Certification Board, etc). It is our expectation that all of our fellows will reach COCATS level 2 (specialized training adequate for routine performance) in the areas of electrocardiography, echocardiography, diagnostic catheterization. A summary of COCATS level requirements is included as Appendix 1 at the end of this document.

ACGME Curriculum Requirements

- Training program 3 years in duration
- Minimum of 24 months clinical training (inpatient and clinical laboratory)
- Minimum of 9 months of non-laboratory (inpatient/outpatient) clinical rotations
- 4 months of cardiac catheterization
- 6 months non-invasive cardiology; the following can be concurrent
  - -3 months echo/Doppler
  - -2 months nuclear

-1 month of other that must include (ambulatory ECG, stress testing, CT, MRI)

- 2 months electrophysiology

ACGME Procedural Requirements (n.b.: these are separate from COCATS requirements)

- Cardiac catheterization – 100
- Exercise stress test – 50
- Echocardiography (TTE or TEE) – 75 performed, 150 interpreted
- ECGs – 3,500
- Ambulatory ECGs – 150

F. Procedural Logs

Many of the procedures performed during the clinical aspect of the cardiology fellowship must be logged in order to a) document required performance for graduation from an ACGME-accredited program; b) to qualify for subspecialty board certification; and c) to verify procedural competence when applying for hospital privileges.

The following procedures must be logged (including patient identifier and date performed):

- Diagnostic cardiac catheterization (including bedside right heart catheterization)
- Coronary or non-coronary interventional catheterization
- Transthoracic echocardiography – interpreted
- Transthoracic echocardiography – performed
- Transesophageal echocardiography
- Temporary pacemaker placement
- Electrical cardioversion
- Stress-ECG studies
- Ambulatory ECG studies

The following procedures should be logged if the fellow is pursuing special qualification, competency and/or eligibility for subspecialty boards:

- Radionuclide studies
- Cardiac CT
- Cardiac MRI
- Electrophysiology studies
- Peripheral vascular interventions
- IABP placement
- Pacemaker interrogation

III. Research Training

A research component is a requirement for all trainees. A two year research program is recommended for those pursuing a career in academic medicine. Selection of a research mentor, based on research interests, should occur by the completion of the first year. There are many basic science, translational and clinical research opportunities at OHSU. The Cardiovascular Medicine faculty includes superb mentors who are recognized internationally for their research and teaching accomplishments. The research component is generally funded through extramural sources coordinated between the fellow and mentor. The particular areas of expertise at OHSU include myocardial perfusion imaging, microvascular physiology, molecular imaging, congenital heart disease, cardiac development, maternal-fetal environment, cardiovascular manifestations of diabetes, thrombosis, EP/device outcomes (population-based) studies, to name only a few. Research opportunities expand outside of the Cardiovascular Division and span the outstanding basic research activities of the Vollum Institute, the Dotter institute for Vascular Medicine, and the Clinical Epidemiology program that sponsors an MPH degree program and the Human Investigation Program (HIP). As part of research training, the fellow will be expected to participate in the appropriate course work as determined by the director of research (Department of Medicine's course, biostatistics, literature review, etc), and to present research ideas/results at the Division Research Conference.

B. Mentors

Please refer to the enclosed list of faculty mentors and research activities which can also be found on our website: ***www.ohsu.edu/cardiology***

IV. Description of Clinical Rotations

Cardiac Critical Care Unit and General Inpatient Cardiology Service

The goal of this rotation is to develop skills in the evaluation and management of inpatients with a spectrum of cardiovascular diseases and presentations. Together with the supervising faculty member, the fellow is responsible for the care of patients in the intensive care unit and the general in-patient cardiology service, excluding 24-hour admissions for post-procedural care. The severity of disease is broad and includes patients with newly diagnosed cardiovascular disease, worsening or decompensation of chronic disease, and acute life-threatening cardiovascular conditions. The disease spectrum is also broad and includes acute and crhonic coronary artery disease, congestive heart failure, arrhythmias, and valvular heart disease. There is also exposure to adult congenital disease, heart transplant patients, and patients on assist devices.

This fellow plays a key role in the evaluation and management of all patients on the service and is responsible for key procedures such as central venous catheter placement, right heart catheterizations, temporary pacemaker placement, cardioversion, etc. Another

role of the fellow is to supervise internal medicine housestaff and medical students that are assigned to the rotation. The primary learning opportunities are through clinical experience, bedside teaching rounds, evening "work" rounds, and core inpatient teaching curriculum that is taught in the form of organized lectures. The fellow participates in providing lectures together with the attending physician.

Educational resources are available in the fellow offices with an extensive bibliography and the American College of Cardiology Self Assessment and Evaluation Program. The trainees will be evaluated by the faculty according to ACGME core competencies and the trainee is expected to submit an evaluation of faculty and the rotation.

Cardiac Consultation Service (OHSU and VAMC)

The consultation service evaluates and follows patients on medical and surgical services, other than the Cardiology Service. The consultation service is also responsible for the evaluation of Emergency Department patients referred for further cardiovascular assessment by the Emergency Department staff; for patients admitted for outpatient procedures who have suspected cardiovascular complications, and for aiding in the outpatient preoperative risk stratification of patients with suspected or known cardiovascular disease.

The goal of the rotation is to improve the trainee's ability to perform a cardiovascular history and physical exam, interpret and analyze the appropriate cardiologic tests, and to integrate these findings into a concise diagnosis with management plan. In addition, the trainee will develop the ability to communicate the findings in a professional manner that conveys accurate, effective, and meaningful information to the referring physician. This will be accomplished, on a daily basis and under the supervision and guidance of the cardiology faculty, through the fellow's observation of and interaction with patients and family, and via review of the cardiologic exam with interpretation of reports and studies.

The fellow trainee is also responsible for overseeing and coordinating the activities of the internal medicine housestaff that are assigned to the rotation. The fellow will be responsible together with the faculty attending physician to review core curriculum of the consult team.

Cardiac Catheterization

The goal of this rotation is to learn the scientific basis and necessary technical skills of hemodynamic and angiographic cardiac diagnostic studies, and percutaneous interventions. A second goal is to train the fellow on how to integrate noninvasive and catheterization laboratory findings in order to provide cost-effective and accurate diagnosis and management of patients with heart disease. The rotation is aimed at meeting the requirements for competency for diagnostic cardiac catheterization and angiography. The teaching components of the rotation are graduated, meaning that responsibility and expected skill levels are based on the level of training.

The responsibilities of the fellow on the rotation include:

- Pre-procedural evaluation of each patient and review of the medical history and prior tests in order to formulate an appropriate diagnostic plan and to assess risk,
- Performance of diagnostic hemodynamic and angiographic studies, and participation in percutaneous interventions and device placement under the direct supervision and guidance of the catheterization laboratory staff
- Interpretation and prompt reporting/communication of the study results and further recommendations, and
- Coordination of activities with the Cardiac Catheterization staff and the primary health care team responsible for patient management (primary inpatient care team, outpatient referring physicians, cardiology consult service, etc.).

Noninvasive Imaging I & II

During the noninvasive imaging rotations, the trainee will become proficient and competent in the performance and interpretation of transthoracic echocardiography, transesophageal echocardiography, stress testing (exercise and pharmacologic), cardiac magnetic resonance imaging (MRI), cardiac CT-angiography, and radionuclide-SPECT imaging. Instruction in the field of imaging is multi-faceted and includes: one-on-one reading sessions, non-invasive imaging conferences, and practical "hands-on" performance of studies under appropriate supervision. The rotations are divided into: Imaging 1 (echocardiography, stress testing, radionuclide imaging); and Imaging 2 (CT, MRI, radionuclide imaging).

The educational goals of the rotations include:

- Knowledge of appropriate indications, contraindications and limitations of imaging methods,
- Knowledge of the physical principles of each imaging method,
- Knowledge of instrument settings and artifacts,
- Knowledge and recognition of normal and abnormal cardiac anatomy and physiology,
- Ability to formulate differential diagnoses based on imaging results,
- Recognition of life-threatening emergencies,
- Proficiency of appropriate quantitative measurement techniques,
- Competency in performing necessary procedural components,
- Ability to report findings and communicate results to referring physicians, and
- Ability to incorporate imaging findings into the clinical management of patients.

Cardiac Electrophysiology (Heart Rhythm) Rotation (OHSU)

The goal of the EP Service is to provide a broad-based background in clinical electrophysiology. The basic components of this rotation for the general cardiology fellow

involve participation in diagnostic and therapeutic electrophysiology studies; management and consultation of inpatients with disorders of cardiac rhythm; management and decision-making in patients needing or who have received device therapy; outpatient management of patients with heart rhythm disorders. There is also adequate opportunity to become familiar with device (lCD/pacemaker) interrogation, management and implantation. Arrhythmia consultation is an important component of training. This will be done on the Inpatient Service and the Arrhythmia Clinics. Analysis of complex arrhythmias is a critical component of procedures performed in the EP lab during electrophysiology studies and interventional studies (radiofrequency catheter ablation).

The educational goals of the rotations include:

- To understand the basic pathophysiologic principles behind cardiac rhythm disorders,
- To be able to interpret complex surface ECGs and intracardiac electrocardiograms,
- To become familiar with indications for when a patient should be managed for their heart rhythm disorder, with drugs, RF ablation or devices,
- To understand the underlying mechanisms of drug therapy and adverse effects,
- To understand the basic principles of pacemakers and/or defibrillators, and indications for their use,
- To be able to provide advanced consultative information on cardiac arrhythmias,
- To become familiar with current guidelines of device therapy and drug management, and also the key underlying economic issues, and
- To become familiar with the resources available to the general physician for self-education on cardiac arrhythmias.

Congestive Heart Failure/Transplant Rotation

The cardiology trainee will develop skill in the initial evaluation and subsequent management of patients with advanced cardiac failure, as well as in the evaluation and management of patients that are undergoing or have received cardiac transplantation. This will be accomplished by participating in the clinic as a primary evaluator of patients, as well as on the inpatient service by doing patient evaluation, discussion, and presentation to the attending faculty. For the most part, the patients on this rotation have advanced heart disease and have been referred for management after conventional therapy has failed. The patients range in age from adolescent to senior citizens. The fellow will be involved in the outpatient and inpatient evaluation, follow-up and management of these patients.

Ambulatory Care Rotation

The cardiology fellow has two continuity clinics, one at the VAMC and one at OHSU. Each meets every other week. The trainee will typically see new patients and follow-up patients in each clinic. There is a broad range of cardiovascular disease and reasons for a cardiology encounter. Cardiovascular conditions that are typically seen include CAD;

congestive heart failure; evaluation of chest pain, dyspnea, syncope, or palpitations; pre-operative evaluation; arrhythmias; peripheral vascular disease; etc. There are generally one to two attending physicians in the outpatient clinic that have the sole responsibility of oversight of evaluation and management activities, and for teaching the practice of outpatient management. Fellows will also be instructed on the appropriateness for diagnostic studies or therapy; effective communication with patients, patient families, and attending physicians; psychosocial aspects of medicine; preventative health care strategies; cost-effectiveness; and systems-based practice.

Adult Congenital Heart Disease Rotation

The purpose of this rotation is to give trainees an in-depth exposure to adults with congenital heart disease. Trainees should reach a comfort level of understanding the major forms of congenital defects, common corrective/palliative procedures, and expected problems in adulthood. Trainees should be able to approach a congenital patient both in the inpatient and outpatient setting and consider the major issues that the patient is likely to face. The trainees should also know how to use noninvasive imaging modalities to properly assess these complex patients, including the limitations of the various methods available, and participate directly in report generation.

The educational goals of the rotations include:

- To understand the basic pathophysiologic principles behind cardiac rhythm disorders,
- Understand the anatomy and pathophysiology of congenital lesions,
- Understand major surgical corrections/palliations for various lesions,
- Identify typical problems faced by adults with congenital defects, and
- Ability to communicate the clinical visit to the patient, medical record, and referring physicians.

Cardiothoracic Surgery Service

The cardiothoracic surgery service is responsible for the evaluation and treatment of patients with cardiovascular conditions that require, may require, or have already undergone surgical intervention. Activities of the service include preoperative evaluation of outpatients, inpatient consultation, urgent and elective surgical procedures, postoperative surgical care, and cardiovascular diagnostic tests relating to cardiothoracic surgical procedures.

The overall goal of the rotation is to improve the cardiology trainee's knowledge of preoperative, intraoperative and postoperative care issues. This is accomplished by direct patient care under the supervision and guidance of the cardiothoracic surgery faculty, through the fellow's observation of and interaction with patients and family, and via review of the cardiologic exam with interpretation of reports and studies.

Specific Educational Goals:

1. To understand indications for surgical intervention of cardiovascular disease,

2. To understand components of the preoperative evaluation and the determination of individual risk versus benefit for surgical intervention,
3. To improve skills in cardiovascular history, physical examination in relation to disease that will be treated either medically or surgically,
4. To learn how to integrate cardiovascular diagnostic tests into a management plan for patients who are being considered for surgery, or in the intraoperative or postoperative setting,
5. To gain skill in communication with patients or families of patients with critical and/or debilitating disease,
6. To gain skill communicating consultative information to referring physicians,
7. To understand the basic components of major cardiothoracic surgical procedures including cardioplegia, cardiopulmonary bypass, coronary artery bypass grafting, valve replacement/repair, thoracic aortic aneurysm/dissection surgery, correction of common congenital heart diseases, and pericardial disease,
8. To better understand anesthesia and intraoperative monitoring methods and procedures,
9. To gain skill in the evaluation of treatment specifically of the surgical patient and to be able to understand and treat postoperative complications, and
10. To understand the psychosocial impact of potential cardiovascular complications in patients who are hospitalized or undergoing major non-cardiac surgery.

Vascular Medicine Rotation

The purpose of this rotation is to provide basic training in the evaluation and management of peripheral arterial disease (PAD). This rotation is coordinated with faculty members from: (1) the Cardiovascular Division with expertise in peripheral artery disease and peripheral interventions, (2) Vascular Surgery, and (3) the Dotter Institute for Interventional Radiology. Activities of this rotation include the multidisciplinary vascular disease outpatient clinic, in-patient vascular consultation, the vascular non-invasive diagnostic laboratory, and the angiography/interventional procedural laboratory.

The educational goals of the rotations include:

- To understand the basic pathophysiology of peripheral vascular disease and its relationship to CAD and diabetes melllitus
- To improve skills in the evaluation and non-surgical management of PAD
- Understand the indications and risks of major surgical or percutaneous interventions
- To learn how to appropriately interpret and integrate non-invasive diagnostic tests (ABI, exercise ABI, TBI, PVRs, TcPO2, Duplex scanning) into clinical practice
- To be able to communicate evaluation and treatment goals to patients and their families.

V. Conferences

General Weekly Conference Schedule (descriptions below):

Monday 12:00-1:00 pm: Journal Club (intermittent)

Tuesday 7:00-8:00 am: Multidisciplinary Conference

Wednesday 7:30-8:30 am: Electrophysiology/Device Conference

Wednesday 12:00-1:00 pm: Case-based Clinical Conference or M&M

Thursday 12:00-1:00 pm: Didactic Lecture Series

Thursday 5:00-6:00: Research conference OR Cardiology Grand Rounds (6 pm)

Friday 7:00-8:00 am: Integrative Physiology Conference

Friday 12:00-1:00 pm: Non-invasive imaging conference

Attendance at the majority of these conferences is mandatory. There are several additional weekly conferences that are components of individual rotations and fellows are welcome to participate in these whenever the opportunity arises. They include the **Internal Medicine Grand Rounds**, the **VA CT-Surgical Cardiology Conference**, **Coronary Angiography and Interventional Conference** and the **CHF/Transplant Review.** Description of each major conference is provided below:

Multidisciplinary Conference

This is a joint conference for the divisions of Cardiovascular Medicine and Cardiothoracic Surgery. The most interesting and challenging cases in coronary artery disease, valve disease, heart failure and arrhythmias are presented and discussed in a moderated fashion. Responsibility for presenting cases alternates between thoracic surgery and cardiology fellows.

Electrophysiology/Device Conference

This conference involves both case-based and didactic learning opportunities. One or two interesting cases involving a challenging cardiac rhythm disorder and/or electrophysiology study is presented in a formal fashion by the subspecialty EP fellow (2 per year at OHSU). The EP faculty lead discussion. Approximately 20-25% of each conference is dedicated to didactic presentation on topic of interest. The complexity of the cases and intracardiac electrograms is increased in a graduated fashion throughout the academic year.

Case-based Clinical Conference

This conference consists of an hour of case discussion or a review of topics. The fellows are responsible for the materials presented, although specific faculty members are assigned to facilitate discussion. The conference generally involves presentation of a case (history, physical examination, diagnostic studies, clinical course) that has important teaching components. A brief review of relevant scientific literature often enhances the case-based learning of these conferences. The Mortality & Morbidity and ECG conferences also occur periodically in this slot.

Didactic Lecture Series

Cardiology and non-cardiology faculty from OHSU and the VAMC provide one-hour didactic lectures on state-of-the-art practice of cardiovascular medicine in all core curriculum

areas. At the beginning of the academic year, introductory lectures are given to provide the basis for more advanced understanding throughout the remainder of fellowship. Most lectures are given yearly, although some will be on an every-other-year basis.

Integrated Physiology Conference

This conference is structured like a graduate student seminar for discussion of key ideas in cardiac pathophysiology and diagnosis. Topics are reviewed in depth; key articles are distributed in advance for the assigned fellow to review and present during the conference. Over the course of three to four years, the trainee will have a broad and deep exposure to cardiac pathophysiology.

Noninvasive Imaging Conference

This conference consists primarily of case-based presentations that further the fellow's interpretation skill and knowledge base in the areas of echocardiography, MRI, radionuclide imaging, and CT. Cases will serve to teach basic principles of disease diagnosis and quantitative techniques. The most interesting and instructive cases are also generally presented at this conference. Key articles and concepts related to major components of noninvasive cardiology will be reviewed. Often, short didactic presentations are given by the imaging fellow according.

Journal Club

The intent of this conference is to review two related articles focusing on the clinical impact of the study. There is also attention paid to hypothesis generation, methodology, and statistical analysis.

Research Conference

The Cardiology Research Conference provides a forum for cardiac investigators within the Division to present research ideas and data. Fellows will present their projects on a periodic basis. Research conference will be given periodically by an invited speaker from outside of OHSU.

Cardiology Grand Rounds

Approximately eight times yearly, a thought leader in cardiovascular medicine is hosted by the Division of Cardiovascular Medicine. In addition to meeting with the Cardiovascular Medicine faculty, the visiting professor will present at Grand Rounds on a Thursday evening. The Grand Rounds Speaker will also give a separate lunch-time lecture to the fellows, and meet with them afterward.